APPENDIX J: EXISTING MONITORING PROGRAMS IN THE KLAMATH REGION

1.0 MONITORING IN THE PARK UNITS OF THE NATIONAL PARK SERVICE

A Table summarizing all monitoring in the Klamath Network Parks that is unrelated to water and air quality is provided at the end of this document. Water and air quality monitoring are covered in greater detail in separate appendices (Appendix F and H respectively). As the Table indicates, a large number of park attributes have been monitored and are currently being monitored. Some highlights include historic mammal surveys by Joseph Grinnell, detailed bat monitoring at Lava Beds, detailed faunal surveys at Lassen, spotted owl and whitebark pine monitoring at Crater Lake, weekly ant and other periodic monitoring in caves at Oregon Caves, and shaded fuelbreak monitoring at Whiskeytown.

1.1 ALLIED ORGANIZATIONS PERFORMING MONITORING IN THE VICINITY OF THE KLAMATH NETWORK, AND OPPORTUNITIES FOR COLLABORATION

A. Federal Agencies

U.S. Department of the Interior, Bureau of Land Management

CA offices: http://www.ca.blm.gov/fieldoffices.html , and links within that page.
OR/WA home page: http://www.or.blm.gov/

As is true across the western United States, the Bureau of Land Management complements the U.S. Forest Service as the other major administrator of public lands in the Klamath and adjacent ecoregions. The Bureau is the most 'multiple-use' of the federal land-management agencies, and its management mandate permits the greatest diversity of uses of the landscape. In this region, prominent uses include mineral-resource leasing (for oil and gas, geothermal, mining, and mineral materials resources); forestry (timber harvest, forest-products sales); free-roaming horses and burros (especially in the eastern portion of the region); and recreation (including gold panning, rockhounding, river recreation, camping, fishing, hunting, off-highway vehicles, horseback riding, hiking, and wildlife watching). Nonetheless, as part of its National Landscape Conservation System, the BLM also administers a diversity of more protected landscapes in the region, including numerous wilderness study areas, >10 Areas of Critical Environmental Concern (ACECs), a National Conservation Area, a Headwaters Forest Reserve, a national

monument, other wilderness areas, Wild and Scenic Rivers, and slightly more to the east, the Steens Mountain Cooperative Management and Protection Area. These are extensive – in Oregon alone, wilderness areas and wilderness study areas encompass nearly 1.2 million ha.

Four BLM districts (Arcata, Redding, Alturas, and Eagle Lake) manage a total of over 825,000 ha in the area circumscribed by the four Klamath-network parks in northern California (Figure 1). This represents only a fraction of the 6.1 million ha of land administered by BLM in California, nearly 15% of the state's area. In southern Oregon, Park Service units are contained within the Lakeview and Medford districts. The 6.36 million ha of land administered by the BLM in Oregon represents about one-fourth of the area of the state.

Figure 1. Administrative divisions within lands administered by BLM-California. Smaller boundaries are counties.

Major programs in California with monitoring components that may be of particular interest to the National Park Service are the noxious weeds, fire management, and special-status-plants programs. This last category includes species that are at least one of the following: a) federally

endangered, threatened, proposed, and candidate species; b) California State endangered, threatened, and rare species; or c) BLM sensitive species. Major programs in Oregon with monitoring components include the Rangeland Health; banding, inventory, and monitoring of northern spotted owls; and watershed-analysis programs. This latter program is a procedure used to characterize the human, aquatic, riparian, and terrestrial features, conditions, and ecological functions on Federal lands within a particular watershed. It is designed to provide a systematic means to not only understand and organize ecosystem information, but also enhance the ability to estimate effects of management activities (BLM Facts: Oregon and Washington 2001; www.or.blm.gov/BLMFacts/2002BLMFACTS.PDF). A diversity of smaller monitoring projects and programs are also directed by the BLM, particularly with respect to management actions (effectiveness monitoring). Particular emphases are exotic plants ("noxious weeds"), trend surveys of soil and vegetation parameters, and use of temporary exclusion cages to measure short-term effects of livestock grazing.

U.S. Department of Agriculture, Forest Service

Links to individual National Forests at http://www.fs.fed.us/recreation/map/state_list.shtml

In Oregon, National Forests in the Klamath ecoregion include the Siskiyou, Rogue River, Umpqua, and Fremont-Winema National Forests, which comprise a total of 1.6 million ha of land. In California, which has 18 National Forests that encompass 8.1 million ha of land, the NPS units of the Klamath network occur amidst the Lassen, Modoc, Six Rivers, Shasta-Trinity, and Klamath National Forests (Figure 2). The enabling legislation for Forest Service management defines the agency's mission as striving "to achieve quality land management under the sustainable multiple-use management concept to meet the diverse needs of people." Whereas the Service historically focused more exclusively on timber production, current trends in management balance harvests with concerns for biological integrity, diversity, and sustainability as well as non-consumptive uses such as bird watching, backpacking, and wildlife viewing. In many cases and especially in the Intermountain West, USFS-administered lands are located at higher elevations than are lands administered by the BLM. Individual National Forests have local monitoring programs that track aspects of ecosystems such as hydrology (geomorphology, water quality, streamside vegetation), community response to prescribed and wildfires, trends in particular wildlife as well as threatened and endangered species (e.g., goshawks, northern spotted owls, marbled murrelets, mammalian forest carnivores, bald eagles, bull trout), sensitive plants, and noxious weeds. As an example of a local yet ambitious and diverse monitoring program in the Klamath ecoregion, see http://www.fs.fed.us/r6/siskiyou/planning/monitoring/2003-monitoring-rpt.pdf. However, the most significant, long-term monitoring efforts of the U.S. Forest Service are their Forest Inventory and Analysis (FIA) Program and efforts related to the Northwest Forest Plan. This latter monitoring was initiated in response to the conservation status of the northern spotted owl, *Strix occidentalis caurina* (listed federally as 'threatened' since June 1990), whereas the former has occurred on USFS-administered and other lands for several decades and will be discussed later in this appendix as a featured monitoring program.

While not as often a source of long-term, consistent monitoring, the research arm of the Forest Service may be of great value to the units of the Klamath network. In addition to possessing scientists with a strong theoretical and often applied understanding of various aspects of forested

ecosystems, USFS research stations have administered a number of local research projects in the Klamath ecoregion, including manipulative experiments and longer-term studies of individual ecosystem components. Forested systems in California are largely the responsibility of the Pacific Southwest Research Station (PSW), while forests in Oregon are largely covered by the Pacific Northwest Research Station (PNW). Researchers in both of these Stations produce a prolific number of publications related to monitoring, many of which have been seminal (e.g., Ralph et al. 1993, Ralph et al. 1995, Mulder et al. 1999). The Intermountain Research Station researches forested systems to the east, with specialties at the Reno field station being riparian systems and paleontology.

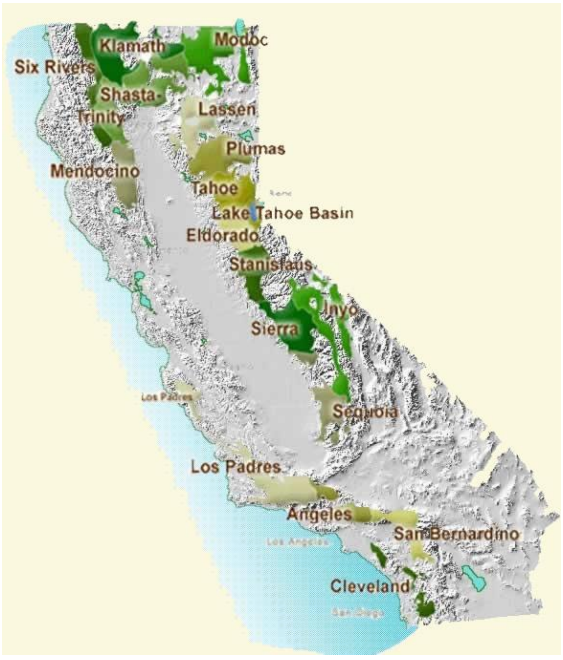


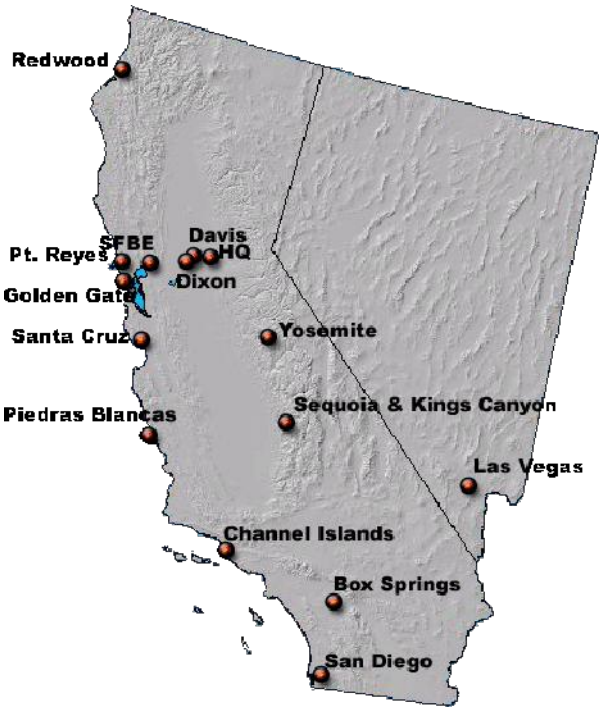
Figure 2. Locations of USDA-FS National Forests within California.

U.S. Department of the Interior, U.S. Geological Survey (USGS)

Oregon portion of the Klamath network: Forest and Rangeland Ecosystem Science Center (FRESC), http://fresc.usgs.gov/
California portion: Western Ecological Research Center (WERC), http://www.werc.usgs.gov/

The USGS is composed of four interrelated disciplines – Water, Geology, Geography, and Biology. Although there are opportunities for the network to collaborate with and gain from expertise in all disciplines, for many aspects of monitoring the greatest overlap in scope will be found in Biology. The only field station in WERC within proximity to the network, the Redwood Field Station, has only one research scientist. Its location is very close to one of the network's units (Redwood). Support for projects can also come from offices farther south (Fig. 3a.). For example, Gary Fellers formerly with Point Reyes National Seashore, has performed limited monitoring of herpetofauna in a number of the Klamath units, described later in the appendix. Within FRESC, a number of scientists have performed research and monitoring studies both within the units of the network, and within the greater Klamath region. Although

not performed at units within the Klamath network, the Amphibian Research & Monitoring Initiative may be useful for the network for providing a framework for design and analysis of monitoring data, as well as field methods for amphibian and reptile surveys. Nearest the network (Fig. 3b), FRESC boasts particular expertise in conservation genetics, invasive plants, and scientific support for monitoring, herpetofauna, contaminants, wetland ecology, rangeland ecology, and biogeochemistry. Long-term monitoring of herpetofauna in network units has been performed by Dr. Gary Fellers at a limited number of sites; this work is described briefly later in the appendix.



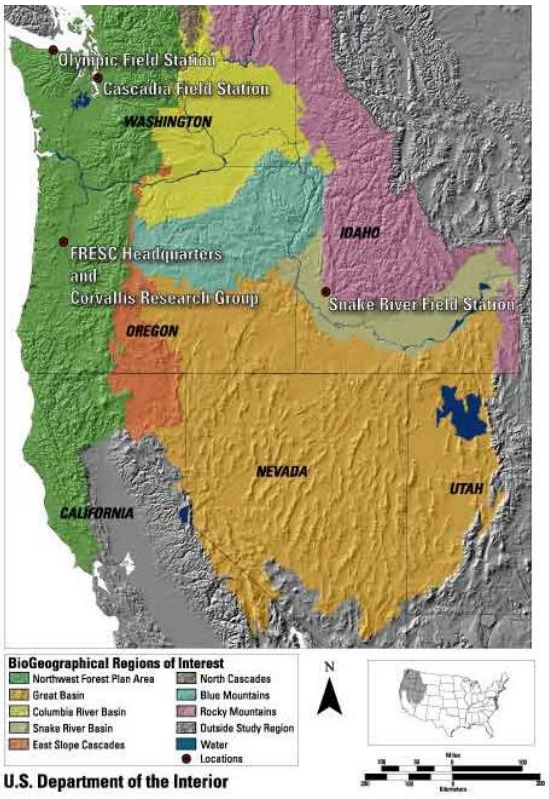


Figure 3a,b. Locations of field stations within USGS. a) Western Ecological Research Center. b) Forest & Rangeland Ecosystem Science Center.

U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS)

Home page for CA activities: http://www.ca.nrcs.usda.gov/ ;
OR activities: http://www.or.nrcs.usda.gov/

Led by a stated vision of "harmony between people and the land," the NRCS' national mission is to provide "leadership in a partnership effort to help people conserve, maintain, and improve our natural resources and environment." Formerly known as the Soil Conservation Service, NRCS has broadened its scope to include a number of conservation programs targeted for farm and ranch owners (e.g., Wildlife Habitat Incentives Program, Wetlands Reserve Program, Watershed Rehabilitation). For example, the 2002 Farm Bill sought to usher in a new way of thinking about

land management; a brief summary of its conservation programs can be found at http://www.nrcs.usda.gov/programs/farmbill/2002/pdf/ProgSum.pdf. At anything broader than the local level, mapping and surveys of soils may be one of NRCS' products most valuable to units of the Klamath network. The Snow Survey Program, which provides mountain-snowpack data and streamflow forecasts for the western United States, may also be used for water-supply management, flood control, climate modeling, recreation, and conservation-planning applications. Offices occur in every county in both Oregon and California.

U.S. Environmental Protection Agency (EPA)

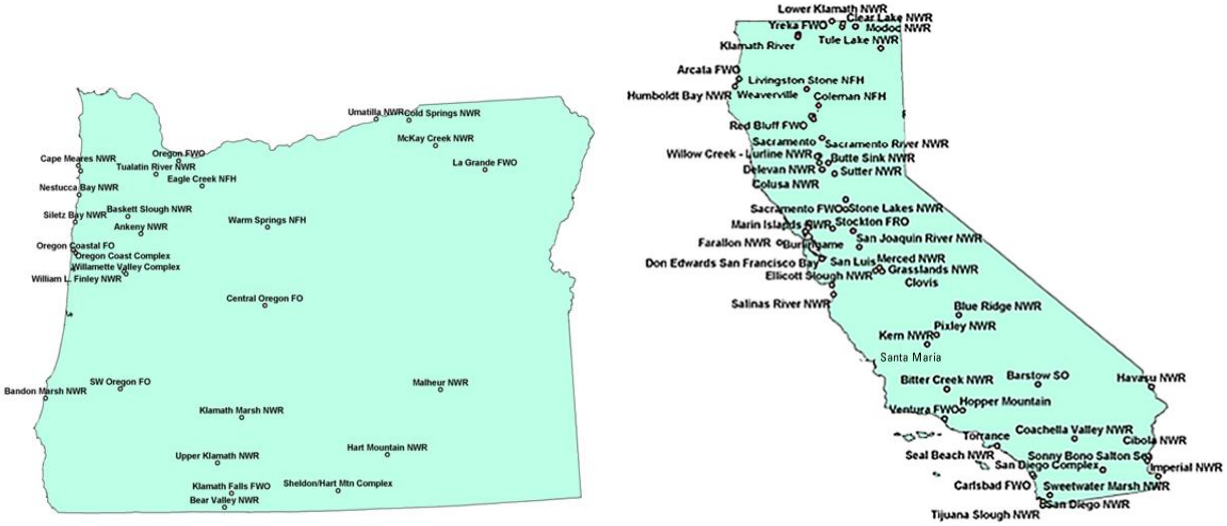
Created in 1970 in response to a growing demand for cleaner air, water, and land, the EPA's stated mission nationally is to "protect human health and the environment." In addition to the agency's primary activity – developing national standards for numerous environmental programs and enforcing environmental laws enacted by Congress – EPA also: a) sponsors voluntary partnerships and programs (with, e.g., industries, businesses, non-profit organizations, and local governments); b) performs environmental research (the office most closely related to the Klamath ecoregion, in terms of both geographic distance and project scope, is the Western Ecology Division of the National Health and Environmental Effects Research Laboratory in Corvallis, OR); and c) offers financial assistance to support graduate fellowships, environmental education projects, and environmental services. In terms of monitoring, the Environmental Monitoring and Assessment Program (EMAP) is the EPA's most significant monitoring effort. Its goal is to "build the scientific basis, and the local, state, and tribal capacity to monitor for status and trends in the condition of the Nation's aquatic ecosystems." Given that only 50 locations across the entire state of Oregon were sampled (and one or none immediately near any NPS unit) on only one occasion (D. White, EPA, Corvallis, OR, *pers. comm.*), the value of EMAP for the Klamath network may lie in its ability to ability to design and modify protocols for multi-scale sampling of aquatic ecosystems. It has also fostered the publication of >600 peer-reviewed articles, some of which may be of value for designing an implementation framework for Vital Signs in the Klamath network. More information about EMAP will be provided later in this appendix. For more about the EPA's mission, programs, organizational structure and office locations near the Klamath ecoregion, go to http://www.epa.gov/epahome/aboutepa.htm#mission.

U.S. Department of Interior, Fish & Wildlife Service (FWS)

Listing of Fish and Wildlife Service national-level programs and functions: http://info.fws.gov/function.html

The FWS administers eight national wildlife refuges within the vicinity of the Klamath network (5 in CA, and 3 in OR), as well as two fish hatcheries (Figs. 4a,b). Whereas the Service historically focused more attention on species that could be hunted or fished, recently the balance in attention to game versus non-game species is shifting more towards the latter, and the attention to the conservation and legal protection of plants and animals has vastly increased. Although all taxa are represented, programmatically in FWS there is currently a slightly greater

focus on fishes and birds, especially migratory species. The FWS works collaboratively with both state wildlife and fish-and-game agencies, as well as with non-profit organizations and volunteers, to increase their efficiency in monitoring threatened, endangered, and candidate plant and animal species. A FWS program of particular note for I&M efforts, but that is less well known, is the National Wetlands Inventory, the goal of which is to provide "current geospatially referenced information on the status, extent, characteristics and functions of wetland, riparian, deepwater and related aquatic habitats in priority areas to promote the understanding and conservation of these resources." A brief summary of the program occurs in USFWS (2002), and can be found electronically at http://wetlands.fws.gov/Pubs_Reports/NWI121StatFNL.pdf. A more complete listing of the Service's programs and functions at the national level can be found at: http://info.fws.gov/function.html.



Figs. 4a,b. Locations of FWS refuges, fish hatcheries, and offices in Oregon (a) and California (b).

B. State Agencies

Oregon Department of Fisheries and Wildlife (ODFW)

Home page: http://www.dfw.state.or.us/

ODFW is the agency responsible for issuing licenses and regulations for game species, in accordance with the status and trends of those species. ODFW's stated mission is "to protect and enhance Oregon's fish and wildlife and their habitats for use and enjoyment by present and future generations." The agency's vision has Oregon's fish and wildlife species "thriving in healthy habitats due to cooperative efforts and support by all Oregonians." Across the state, there appears to be a particular focus on salmonids, in terms of not only the management expenditures, but also monitoring and research monies dedicated in sole and collaborative efforts of ODFW. Past and present scientists and administrators at ODFW made significant contributions to a sourcebook volume on 593 wildlife species and their relationships with the 32 terrestrial, freshwater, and marine habitat types of Oregon and Washington (Johnson and O'Neil 2001).

This document appears to hold great potential utility as the Vital Signs process matures. Whereas the majority of the agency's monitoring efforts are dedicated to tracking abundance and distribution of game (fished, hunted, or trapped) species, increasing attention has been afforded to concurrent monitoring of the habitats upon which these species rely, especially for stream-dwelling fishes. Many of these monitoring strategies have been developed in cooperation with University and other scientists, and involve sampling designs and methodologies that allow population estimation across various spatial scales and with quantitative estimation of uncertainty (especially for fishes).

California Department of Fish & Game (DFG)

Home page: http://www.dfg.ca.gov/

The Department's stated mission is "to manage California's diverse fish, wildlife, and plant resources, and the habitats upon which they depend, for their ecological values and for their use and enjoyment by the public." The Department also "maintains native fish, wildlife, plant species and natural communities for their intrinsic and ecological value and their benefits to people. This includes habitat protection and maintenance in a sufficient amount and quality to ensure the survival of all species and natural communities." As an indication of its foci and priorities, the Department is organized into three divisions. 1. The Habitat Conservation Division which in turns contains the Central Valley Bay Delta, Habitat Conservation Planning, Native Anadromous Fish and Watershed Restoration, and Wildlife and Habitat Data Analysis branches. 2. The Office of Spill Prevention and Response, which contains, among others, the Marine Safety and Scientific Branches). 3. The Wildlife and Inland Fisheries Division. All of the Klamath-network units occur within the DFG's North Coast Region, which is headquartered in Redding (Fig 5). Like its Oregon counterpart, DFG historically was focused more strongly on monitoring trends in game species. Thus, data for game species usually still are the longest in duration, greatest in sampling intensity, and well-developed in terms of sampling design and method. In contrast with ODFW, however, anadromous fishes currently use a much smaller proportion of the area of California than of Oregon. Again, like ODFW, the California DFG is giving increasing attention and financial resources to nongame species as well as to non-consumptive uses of fish and wildlife species. The shift in demographics of individuals with whom the DFG interacts has both encouraged and justified this shift in focus, both ideologically and in terms of financial base. The DFG has long maintained a strong analytical component to its activities, and has had its own peer-reviewed journal (*California Fish & Game*) operating for multiple decades now. By law, the Department has responsibility for periodic monitoring of the state's diverse biological resources to assure their conservation for current and future residents. Monitoring involves not only assessing the status of individual species, but also that of their habitats. The products produced by DFG appear to verify this commitment, as a search for "monitoring" from the Department's main page produced a listing of 1,317 documents. Of particular interest for the network is the Department's Resource Assessment Program (CDFG 2001; available at http://www.dfg.ca.gov/habitats/rap/pdf/resassessprogram.pdf).

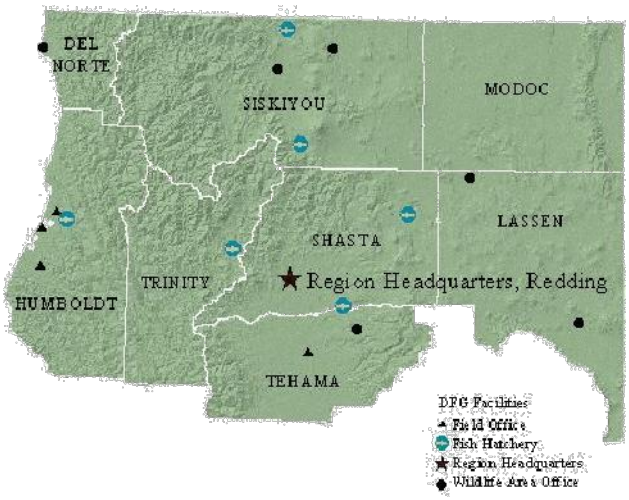


Figure 5. Locations of California DFG offices and fish hatcheries in the North Coast Region.

The California and Oregon State Park systems

Home page for CA parks: http://www.parks.ca.gov/ ; for OR parks: http://www.prd.state.or.us/

State parks (179 units in Oregon, and >270 units occupying 0.53 million ha in California) in a sense are most similar to National Parks in their enabling legislation, but often are smaller in extent and more permissive of activities within their boundaries. To illustrate the similarity of mandate, the mission of the California State Park system is "to provide for the health, inspiration and education of the people of California by helping to preserve the state's extraordinary biological diversity, protecting its most valued natural and cultural resources, and creating opportunities for high-quality outdoor recreation." Monitoring within the State Park systems is usually effectiveness monitoring, that is, performed to ensure the efficacy of a particular management action. Monitoring other than this is generally performed in collaboration with another agency or organization. The State Park within the coastal redwood zone are jointly managed with Redwood National Park, creating the collaborative entity Redwood National and State Parks.

C. Other Institutions and Organizations

Partners in Flight, Christmas Bird Counts, Breeding Bird Surveys, Klamath Bird Observatory

Established in 1990 because of growing concerns about declines in populations of many species of land birds, Partners in Flight focused initially on neotropical migrants but has since broadened to seek to conserve most landbirds (especially those not covered by already existing conservation initiatives). Partner's in flight can be defined as a cooperative effort involving partnerships among federal, state, and local government agencies, philanthropic foundations, conservation groups, industry, researchers, and private individuals. Cooperation between North and South America is a central premise to the mission of Partner's in Flight. Oregon and California form

part of the Western Working Group, which includes Alaska and states as far east as Montana and New Mexico. Breeding Bird Surveys, which involve workers and volunteers of varying levels of experience, occur extensively both in time and space.

The Klamath Bird Observatory is a nonprofit scientific entity that conducts varied land and water bird surveys on private, state, and federal lands in the region. Their monitoring programs include black tern monitoring in the Klamath Basin, International Bird Monitoring for neotropical species, monitoring of marsh passerines, small owl monitoring, and songbird demographics. The Klamath Bird Observatory has worked with the Klamath Network conducting basic songbird inventories over the last two years. The Point Reyes Bird Observatory has conducted inventories and developed a preliminary monitoring plan for Lassen.

The Nature Conservancy

Home page for Oregon Chapter: http://nature.org/wherewework/northamerica/states/oregon/
Home page for California Chapter: http://nature.org/wherewework/northamerica/states/california/

The Nature Conservancy's stated mission is "to preserve the plants, animals and natural communities that represent the diversity of life on Earth by protecting the lands and waters they need to survive." The Conservancy's approach is to purchase high-integrity landscapes or create a diversity of conservation agreements (e.g., conservation easements) that balance human needs with long-term conservation of biological resources. In California, the Nature Conservancy's current projects that abut the Klamath network include the Lassen Foothills and Northern Sierra Projects. In Oregon, five areas are protected or managed by The Nature Conservancy – three in Southwest Oregon (the Agate Desert, Eight Dollar Mountain, and Lower Table Rock Preserves), and two in the Klamath Basin (the Sycan Marsh and Williamson River Delta Preserves). The Nature Conservancy has been actively involved in ecoregional planning that spans broad landscapes and ownerships. Their broad and innovative perspective may be useful as a model of how to develop partnerships that span land ownerships.

Regional Universities

California State University-system institutions (e.g., Chico, Humboldt, Sacramento)
University of California-system institutions (e.g., Davis, Berkeley)
Southern Oregon University

Individual researchers from these and other universities have performed individual research projects on a number of ecosystem components and attributes in the Klamath ecoregion. A number of these have been identified as having occurred within the boundaries of the Klamath network's units, and these appear scattered throughout the master list of monitoring projects that have occurred within the network units (Attachment 1.

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ATTACHMENT 1. MONITORING IN THE NATIONAL PARK UNITS OF THE KLAMATH NETWORK.

Park(s)	Object monitored, or monitoring project	Year(s)	Parameters of primary interest	Covariate(s)	Product(s)	Metadata location and elements	Comments
	I. Composition and structure						
	A. Vertebrates						
	1. Mammals						
LABE	Wildlife observations	1960-Present	Common name, location	Scientific name, number, location, date, time, weather, observer, UTM coordinates	Internal database, GIS theme		Based on standard NPS Wildlife Observation forms submitted by visitors and staff.
LABE	Monitoring of maternal colonies, Townsend's big-eared bat	1988-Present	Cave location	Number of bats documented during outflights	Summary reports; closures of bat caves in summer	Bat observations: \\Labe01\teams\Resource Management\bats\Bat Obsevation Spread Sheets, Bat Database: \\Labe01\teams\Resource Management\Databases\Access MDB	
LABE	Colony monitoring, Townsend's big-eared bat hybernacula	1998-Present	Cave location	Number of bats on walls of caves	Summary reports	LABE Resource Office Cabinet	
LABE	Monitoring of maternity colonies, Mexican free-tailed bat	1988-Present	Number of bats	Adults/Immatures. Flight duration. Photos taken at designated times.	Summary reports	LABE Resource Office Cabinet	Protocols developed by Dr. Steve Cross, SOU.
LAVO	Terrestrial vertebrates (small	2000-	Productivity,	Vegetation;	Annual	Park files;	Protocols

Park(s)	Object monitored, or monitoring project	Year(s)	Parameters of primary interest	Covariate(s)	Product(s)	Metadata location and elements	Comments
	mammals, reptiles, amphibians, carnivores)	Present	abundance, survival, species composition, and distribution	weather; ground-dwelling arthropods (limited)	reports,conference poster, shrew publication *in press*	voucher specimens at MVZ, UC Berkeley	developed by Dr. Gary Fellers, USGS. Coordination w/ MVZ.
LAVO	CA Dept of Health Service Rodent Monitoring	Sporadically, 1966-Present	Relative abundance, distribution	Ecotoparasites	Summary reports	Park files	Sampling focused in campgrounds, but some backcountry locations have also been sampled.
LAVO	Sierra Nevada red fox	1997-Present	Abundance, distribution, survivorship, productivity, diet, taxonomy	Presence and distribution of other carnivores	Annual reports, conference papers and posters, dissertation expected 12/04	UC Berkeley, Park files	Begun as an interagency effort in 1997. Taken on as a Ph.D. dissertation by John Perrine of UC Berkeley in 1999.
LAVO	Species-observations database	ca. 1940s-Present	Opportunistic wildlife sightings by visitors and staff		Database	Park files	
LAVO	Vertebrate transects by Grinnell team (UC Berkeley)	1923, '26, '27, '28, '29	Presence and distribution of vertebrate species	Habitat associations	Book: Vertebrate Natural History through Lassen Peak	Field notes and vouchers at MVZ	
LAVO	Surveys of deer trends with spotlighting	1996-Present	Relative abundance, sex ratio, age distribution		Annual reports	Park files	Interagency effort with CA DFG and USFS
LAVO	Deer populations and habitats	1977-1984	Deer population density and fawn production	Vegetation composition and density	??	Park files	
LAVO	Bear-sighting reporting	1995(?) -	Bear sightings	Location, date,	Periodic internal	Park files	

Park(s)	Object monitored, or monitoring project	Year(s)	Parameters of primary interest	Covariate(s)	Product(s)	Metadata location and elements	Comments
		Present		activity observed	reports		
ORCA	General mammal survey	1936, 1951+D9	Species present		Journal article (citations needed)	Park files & library, NPSpecies list	Also have usage patterns of bats: 1976, 2002+I51
ORCA	Mammal bones in cave	2000-2001	Species present		Abstract at paleological meeting	Park files	Journal article expected to be pulished in *Northwest Science*
ORCA	Small mammals	1998-2003	Edge effects; fire; feeding by visitors	Climate change	Annual reports	Park files, NPSpecies list	
ORCA	Bats on surface (aboveground)	2004 - not yet started	Numbers and species	Prey availability	Report	Park files	
ORCA	Fishers and martens	2002	Fire, habitat, presence	Climate change	Report - fisher presence	Park files, NP Species list	
ORCA	Bats in cave	1950s to Present	Numbers, species, and timing of flight		Journal article, IARs	Journal article (1959)	
	2. Fishes and other aquatic taxa						
LAVO	Underwater observations of aquatic biota	1992-Present	Trends in occurrence and distribution of vertebrate, invertebrate, and plant species		Annual reports, videotapes	Park files, HSU (Arcata).	Underwater observations and collections performed by Dr. John DeMartini (HSU). Many sites have been visited over multiple years. Project does not utilize formal monitoring protocols.
LAVO	Fish populations, Manzanita Lake	1976-1989	Relative abundance and age structure, by		Park report	Park files	Monitoring not conducted in

Park(s)	Object monitored, or monitoring project	Year(s)	Parameters of primary interest	Covariate(s)	Product(s)	Metadata location and elements	Comments
			species				1977, '79, '81, '82, nor '88
LAVO	Creel censuses, Manzanita Lake	1990-Present	Fish size and species		Summary reports	CA Dept of Fish and Game files	Questionaires filled out by park visitors
	3. Reptiles & amphibians						
LAVO	See projects above -- terrestrial vertebrates, species observations, vertebrate transects by Grinnell, and underwater observations.						
ORCA	Fossils in cave	2000-2001	Climate change	Depositional processes	Journal article (citations needed)	Park files, NP Species list, NAU museum	
ORCA	Edge effects on herpetofauna from logging	1997	Adjacent logged areas as biologic sinks	Habitats	Journal article (citations needed)	Park files, NP species list	
ORCA	Surface survey	2002	Habitat distribution		Presence/absence and habitat	Park files, NP species list	
	4. Birds						
LABE	Survey of bird migration	2003-Present	Abundance, Presence/Absence	Vegetation composition and density, weather, temperature.	Annual (Internal) reports	Park files	
LABE	Eagle roost outflight	1987-Present	Number of eagles leaving roost	Mature/Immature, time, weather, temperature, roost count	Internal report		Log sheets in N1621 file
CRLA	Northern spotted owls	1992-Present	Owl demographics: fecundity, survivorship, site fidelity	Barred owl invasion (species dynamics)	Annual reports		Ongoing with OSU Cooperative Extension
LAVO	Monitoring avian productivity and survivorship (MAPS)	1997-Present	Productivity, survivorship, abundance	Species diversity and richness	Annual reports, confer. poster, annotated bird checklist	Park files	Use national MAPS protocols; one permanent

Park(s)	Object monitored, or monitoring project	Year(s)	Parameters of primary interest	Covariate(s)	Product(s)	Metadata location and elements	Comments
							MAPS station in Warner Valley.
LAVO	Breeding Bird Survey	1972-Present	Trends in relative abundance, distribution		Annual reports	Park files, USGS (Patuxent Envir. Science Center)	National monitoring effort
LAVO	Nest monitoring, bald eagles	1980-Present	Nest productivity		Annual reports	Park files	Cooperative effort managed by CA Dept. of Fish and Game
LAVO	Nest monitoring, peregrine falcons	1997-Present	Nest productivity		Annual reports	Park files	Baseline survey in 1980
LAVO	Bufflehead ducks	1997-Present	Brood production, population trends	Fish presence, lake characteristics	Annual reports, confer. poster	Park files	Interagency effort with USFS; survey work by Dan Airola in late '70s and early '80s.
LAVO	CA spotted owls	1991-Present	Survival, productivity, site/mate fidelity, dispersal	Diet composition, vegetation	Annual reports, conference posters and papers	Park Files, PSW Files	USFS, Pacific Southwest Research Station
ORCA	General bird survey	1936	Species number and seasonal changes		Unpublished report	Park files	
ORCA	Census of owls other than spotted owls	2002	Flammulated (present) and barred (absent)		Unpublished report	Park files	
ORCA	Census spotted owls	1997-2004	Number of adults and fledlings and location of nests				
ORCA	Audio bird survey	1999-2004					
ORCA	Mist-netting birds	2002-2004	Loss of winter habitat for neotropical migrants	Food from visitors	Unpublished report	Park files	
WHIS	Bald eagles	1990-Present	Abundance and recruitment	Nest location	Data for NEPA compliance	R. Weatherbee's hard drive.	

Park(s)	Object monitored, or monitoring project	Year(s)	Parameters of primary interest	Covariate(s)	Product(s)	Metadata location and elements	Comments
	B. Invertebrates						
	1. Butterflies						
LABE	National butterfly survey	1995	Location	Species, numbers	Butterfly species list	Species list:\\Labe01\teams\Resource Management\Inventory & Monitoring; field notes: N1429 file, LABE resource office	1-year project. Protocols developed were based on a long-term monitoring program. No staff or funds have been placed on this project since 1995.
ORCA	Census buterflies	1995	Habitat specificity	Climage change	List of 40 species	Park files	
	2. Ants						
ORCA	Weekly census of ant activity in cave	2004	Threats to cave endemics	Climate change	Weekly inventory	Park files	
	3. Other insects						
LAVO	Gypsy moth trapping	~1985-Present	Presence of gypsy moths		County reports	Tehama County files	Project administered by Tehama County
LAVO	Jeffrey pine bark beetles (JPBB)	1995-Present	Mortality of Jeffrey pine from JPBB; JPBB activity		Annual reports	USFS, Susanville, CA	PI = Dr. Sheri Smith, entomologist; Project is located in ML Cmpgrd and Lost Creek area
ORCA	Census moths	2001-2003	Habitat specificity in cave	Climate change	List of 230 species	Park files, Jeff Miller at OR St. Univ.	
ORCA	Census beetles	2003-2004	Species and habitats		List of species & habitats, journal article	Park files	

Park(s)	Object monitored, or monitoring project	Year(s)	Parameters of primary interest	Covariate(s)	Product(s)	Metadata location and elements	Comments
	4. Marine organisms (molluscs, crustaceans, etc.)						
	5. Other inverts						
ORCA	Census freshwater benthic species	2003	Timed abundance every 50 feet (more detail needed).				
ORCA	Census cave species	1992-1993	Edge effects from trails, effects of airflow	Climate change, habitat specificity	List of 240 species	Park files	
ORCA	Census snails and slugs	2000	Effects of geologic substrate, water abundance	Water abundance	List of species and commentary	Park files	
	C. Vascular plants						
	1. Tree species						
CRLA	Long-term monitoring of whitebark pine (WBP)	2003-Present	Infection and death rates of whitebark pine (WBP) from blister-rust disease, mountain pine beetles, and other agents	Species composition and cover of WBP-associated plants			Ongoing; parameter of primary interest and covariate both being monitored to detect changes due to factors such as climate change, succession, and natural disturbance.
LAVO	Fire-effects monitoring	1990-Present	Pre- and post-burn fire effects on vegetation charactieristics; tree DBH and density by species; relative cover by species;	Scorch heights, crown scorch %, burn severity	Internal reports	Park files, REDW files.	Fire-effects team stationed at REDW

Park(s)	Object monitored, or monitoring project	Year(s)	Parameters of primary interest	Covariate(s)	Product(s)	Metadata location and elements	Comments
			shrub density and age by species; fuel load by size class				
LAVO	Primary-forest succession in Chaos Jumbles	1992, 2002	Survival, growth, reproductive maturity rates	Affects of elevation, slope, aspect on forest dynamics	Final Report	Texas Christian University	P.I. = Dr. Glenn Kroh
LAVO	Plant succession in the "Devastated area"	1960, '61, '62, and 1979	Cover and density by species; tree height; successional patterns (I.e. species composition patterns over time)	Soil texture, pH, soil macronutrients, tree age, small mammal abundance, and anecdotal information on other vertebrates and invertebrates.	Final reports	Park files	P.I. = Dr. Warren Bailey. Nine permanent plots. Two of the nine plots were previously established and sporadic measurements taken from 1935-1955 by Carthew, Burgess, Patterson, and others.
LAVO	Weeds	2000-Present	Density, by species	Canopy cover, distance to water	Annual reports	Park files	Perm. Plots established at Butte Creek, Warner Valley, Lost Creek
LAVO	Snag demographics	1988-Present	Temporal and spatial patterns in snag demographics. Snag recruitment and retention (when does it change from a standing dead tree to a downed log) by species and diameter class.	Decay patterns of fire-killed and insect-killed trees, relationships between woodpeckers and beetles, abundance of cavity-nesting	Annual reports, confer. posters and papers, publications	Park Files, PSW files	P.I. = Dr. Bill Laudenslayer. Five permanent plots.

Park(s)	Object monitored, or monitoring project	Year(s)	Parameters of primary interest	Covariate(s)	Product(s)	Metadata location and elements	Comments
				birds (1989-1991)			
LAVO	Forest Inventory and Analysis (FIA)	2001-Present	Tree growth, mortality, crown condition, incidence of insects and pathogens, density of seedlings/saplings, soil samples, down woody debris, vertical structure by species.	Soil: basic nutrients, pH, soil aluminum, erosion; lichen communities	Annual reports	USFS, PNW, Portland	P.I.= Paul Guarnaccia
LAVO	Project FOREST	1991-1995, 2001	Temporal and spatial ozone injury to yellow pines	Incidence of pathogens and insects	Reports, publications	USFS, PSW, Riverside	Interagency project. P.I. = Dr. Paul Miller
ORCA	Weight of woody fuels per acre	1999	Fire threats to Monument	Vegetation communities	Unpublished report	Park files	
WHIS	Hazard trees	1994-Present	Location and defect	Location, DBH, defect	Defect trees are cut down.	S. Femmel's hard drive.	
All Parks where burning occurs	NPS Fire Monitoring Hanbook (FMH) prescribed monitoring	1991-Preseent	Fire effects on vegetation	Fuel reduction	Tree mortality, vegetation change, fuel reduction	Network, REDW network, Tim Bradley's computer	Alternative, non-FMH data incuded on Network and Tim's computer.
	2. Shrubs in semiarid systems / "understory" in mesic systems						
LABE	Vegetation transects	1988	Location, species, densities		Updated species list, frequency, trends in dominance	Goforth's Vegetation Transect Program; LABE Resource Management file cabinet N1433	One-year project.
LAVO	See fire-effects and FIA						

Park(s)	Object monitored, or monitoring project	Year(s)	Parameters of primary interest	Covariate(s)	Product(s)	Metadata location and elements	Comments
	projects, mentioned above						
ORCA	General vascular plant surveys	1948-1953, 1990-2004	Species, distributions	Climate change, debris-flow effects	Lists	Park files, NPSpecies list	Grasses, sedges and rushes inventoried by Peter Zika (affiliation?)
WHIS	NPS FMH (see above)						
WHIS	Shaded fuelbreak monitoring	2001, 2002, 2004	Cover and abundance of exotic plant species in fuelbreaks; canopy cover, litter depth, aspect, slope, age, and conditon of each fuelbreak.		Technical reports, presentations, adaptive management feedback loop	Jennifer Gibson (http://www.werc.usgs.gov/fire/seki/ffm/whiskeytown/whiskeytown.htm).	
	3. Threatened and Endangered plants.						
LAVO	Rare plants, Lassen Peak	1997-Present	Relative cover and density, by species		Annual report	Park files	Protocols developed by Mary Ann and David Showers (California Dept. of Fish and Game)
LAVO	Rare-plant releves, other alpine areas	1981	Cover and density, by species		??	Showers' files, Sacramento, CA	Performed by M. and D. Showers. Several permanent plots were established on Ski Heil, Loomis Peak, and other alpine areas. Scheduled for re-reading in 2006.

Park(s)	Object monitored, or monitoring project	Year(s)	Parameters of primary interest	Covariate(s)	Product(s)	Metadata location and elements	Comments
WHIS	*Puccinellia howellii* (also see last WHIS entry, below)	1991, 1993, soon to include 2004	Cover of *Puccinellia* and associated spring species	Substrate, hydrology, water chemistry, soil chemistry	Caltrans mitigation report, HSU publication in Madrono	J. Gibson's desk.	Hoepfully, WHIS will be archiving the raw data soon.
WHIS	Shasta County *Arnica* monitoring	N/A					
	4. Remote sensing or other vegetation mapping						
LABE	Alien-plant control	1984-1996 (Pre-GPS); 1997-Present	Location, species, and number of plant individuals controlled		Internal reports, control results data, control planning data, GIS theme, posters		Incorporates alien-plant survey, tactical GIS theme for mapping plants, and evaluating control efforts
LAVO	Aerial reconnaisance of bark-beetle outbreaks	1982(?)-Present	Size, pattern, and distribution of bark beetle-caused tree mortality		Maps, reports	Supervisor's Office, Lassen NF	Conducted by Lassen National Forest annually
LAVO	Vegetation-mapping project (1936)	1936	Vegetation communities, parkwide		Park-wide vegetation map	Park map files and GIS	Digitized in 1992
LAVO	Stand composition mapping project	1965	Stand structure (e.g. crown cover by overstory trees, crown cover by understory trees, ground cover by shrub/grass species, density (stems/acre) of tree seedlings/saplings.) and species composition, parkwide		Park-wide maps, approx. 1:16,000 scale	Map files	
LAVO	Habitat map	1999	Vegetation-based		Digital map	Park GIS	Composed from

Park(s)	Object monitored, or monitoring project	Year(s)	Parameters of primary interest	Covariate(s)	Product(s)	Metadata location and elements	Comments
			Wildlife Habitat, parkwide				1936 vegetation map, 1965 stand-composition maps, and CALVEG (USFS Vegetation Classification in CA).
ORCA	LIDAR survey of entire Monument	2004 - incomplete	Canopies and ground levels				
ORCA	Vegetation plots	1997-2003	Effects of prescribed burns				
ORCA	Hand pulling of non-native species	1989-2004: annually	Locations of sites, #individuals, #species				
WHIS	Vegetation map	Incomplete	Cover and structure of species.	Fuels		HSU - Dr. John Stuart's lab. Fuels DataBase on WHIS Network	Fuel model association in development
	D. Mosses, lichens, bryophytes, cyanobacteria, and other nonvascular pls.						
LABE	Lichen survey	1954	Species				One-year project.
ORCA	Census mosses and liverworts	1995	Old-growth and riparian habitats				
ORCA	Distribution of algae and bacteria at areas near cave lights	1989-Present	Effectiveness of bleach-control measures		IAR reports	Park files, IAR	
ORCA	Census lichens	2002	Species new to North America; habitats occupied				
ORCA	Census bacteria and algae near cave lights	1988	Species present	Locations in cave	Unpublished report	Park library and files	

Park(s)	Object monitored, or monitoring project	Year(s)	Parameters of primary interest	Covariate(s)	Product(s)	Metadata location and elements	Comments
	E. Fungi						
ORCA	DNA sampling of fungi, bacteria, Archaea	2001-2003	Effects of trail compaction on biological diversity				
ORCA	Culturing of common genera in cave	1999	Habitat specificity	Effects of visitors on microbial diversity	List of genera	Park files	
	F. OTHER life forms (e.g., bacteria or viruses of disease interest)						
ORCA	Census macrofungi (hand specimens)	2000-2004	Habitat specificity; moisture and host requirements	Climate change	List of species and locations	Park files	
ORCA	Census microfungi (cultured)	2002-2004	Habitat specificity; moisture and host requirements	Climate change	List of species and locations		
	II. Ecological and evolutionary processes						
	A. Geological processes						
	1. Earthquakes / volcanism						
LABE	Seismic recorder	1982-Present	Seismic motion, force 3 and above		Film recorder, upgraded in 2004 to real-time datalogger; Quake map at www.quake.ca.gov		Data at California Geological Survey, Sacramento
LAVO	Seismic monitoring	1980-Present	Number, location, and magnitude of seismic activity		Weekly, quarterly, and annual reports		Monitored by USGS Earthquake Lab
LAVO	Geothermal monitoring	1983-Present	Location, distribution, and		Internal reports		Monitored by USGS, Menlo

Park(s)	Object monitored, or monitoring project	Year(s)	Parameters of primary interest	Covariate(s)	Product(s)	Metadata location and elements	Comments
			physical properties of thermal features (e.g., outflow, temp., pH, chemical composition, isotopic composition)				Park CA
ORCA	Record felt earthquakes on surface and in cave	1989-Present	Differences between cave and surface; cave damage	Evidence of prehistoric damage of cave formations	Written summary of evidence	Park files - cave guide for interpreters	
	2.Hydrogeomorphology						
ORCA	Inventory of drip rates, associated cave features	1997-1999	Water-flow effects (need examples of effects)	Climate change and seasonal changes	GIS mapping with point values	Resource Management computer	
ORCA	Dye tracing of water paths to main cave	1993	Rate, volume and timing	Age of water (not determined)	Rate and location of dye appearance	Park files	
	3. Soils mapping						
LABE	Soils map of LABE	1978-1982	Survey was basically qualitative. No sampling occurred.	No sampling was conducted during two surveys.	A soil map was developed from a publication.		Soil and Conservation Service and Modoc National Forest (1978-1982). These two projects covered different areas. The National Forest surveyed inside the park and the SCS surveyed outside the park boundaries.
ORCA	County soils map	1983	Distribution of soil				

Park(s)	Object monitored, or monitoring project	Year(s)	Parameters of primary interest	Covariate(s)	Product(s)	Metadata location and elements	Comments
			types in county				
ORCA	More detailed mapping of soil units than in county map	2003	pH, particle size, depth, major nutrients	Slope, aspects, underlying lithology	Paper map	Park files	
ORCA	Mapping of compaction on trails in main cave	2004 - incomplete	Compaction	Mitigation from other areas in cave			
WHIS	Soils map	1971			USFS PSW Experimental Range Station Report		NPS is in the process of digitizing this information.
	4. Erosion						
LAVO	See FIA monitoring, mentioned above						
ORCA	Study of 1964 debris flow	1965	Logging, creep buildup, loading failure				
ORCA	Study of sediments impacting water supply	1985	Logging, road failure			Park files	
	B. Hydrological processes						
	1. Water-quality monitoring						
LABE	[USGS] Groundwater study: Upper Klamath Basin	2001-Present	Water level sampled quarterly	Sample water levels at 4 wells within the monument, determine direction of ground-water flow	Graphs showing results for all wells monitored	Graphs are stored in file cabinets of Chief of RM; data collected are available in published reports and on the Internet.	
LAVO	Water quality	1984-Present	Inorganic, organics, general mineral, volatile organic		Annual reports	Park files	Conducted by park Maintenance

Park(s)	Object monitored, or monitoring project	Year(s)	Parameters of primary interest	Covariate(s)	Product(s)	Metadata location and elements	Comments
			contaminants, synthetic volatile organics, radiological contaminants, physical quality, pestcides, herbicides, nitrite, nitrate, asbestos, metals (Pb, Mn, Cu, Al).				Division in seven watersheds
ORCA	Determine major ions, pH, and temperature of cave and stream water	1992-1993	Relate quality to source input into cave	Organics, calcite solubility	Dbase database	Resource Management computer	
ORCA	Determine calcite solubility per season & type of input	1997, 1999	Seasonal changes and types of inputs				
WHIS	Water quality, Willow Creek	2002-Present	Trace metals, pH, specific conductivity, turbidity, dissolved oxygen, etc.	Discharge	Technical paper, pending	B. Rasmussen's desk	STORET
WHIS	Water quality, Paige-Boulder Creek	1999-Present	pH, specific conductivity, turbidiity, dissolved oxygen, etc.	Discharge	Technical paper, pending	B. Rasmussen's desk	STORET
	2. Snowpack / stream gauging						
LABE	Precipitation profile	1996-1997	Monthly precipitation at 7 remote locations		GIS theme		
LABE	Ice level in select caves	1988-Present	Ice levels	Sampled quarterly	Internal reports	Info in resource office file cabinet	
LAVO	Snow characteristics	1930-Present	Snow depth, water content		Real-time website tables	http://cdec.water.ca.gov/staInfo.html	Maintained by Dept of Water Resources. In

Park(s)	Object monitored, or monitoring project	Year(s)	Parameters of primary interest	Covariate(s)	Product(s)	Metadata location and elements	Comments
							late 2003, data acquisition shifted from manual (conducted by PGE field staff) to satellite-based.
ORCA	Stream output from cave	1992	Seasonal changes				
ORCA	Infiltration rates in cave	2000-2003	Permeability, water quality, nutrient levels				
	C. Climatic influences						
	1. Air quality / visibility						
LABE	Air quality-Pm10	1994-Present	Particulate matter, to 10 microns		Raw data at California Air resources Board		
LABE	Air quality-IMPROVE Station	2000-Present	IMPROVE (particulates)		Raw data at NPS Air Qualiry Division		
LABE	Air quality-Ozone	1998-Present	Passive ozone samplers		Raw data at NPS Air Quality Division		
LAVO	Ozone	1988-Present	Ambient ozone		Annual report	NPS Air Quality Division	
LAVO	CASTNet (Clean Air Status and Trends Network)	1995-Present	Dry acid deposition		Annual report	NPS Air Quality Division/EPA	
LAVO	NADP (National Atmospheric Deposition Program)	2000-Present	Wet acid deposition		Annual report	CAL (Champaign IL)	
LAVO	IMPROVE (Improving Protected Visual Environments)	1988-Present	PM10 and PM2.5 particulates		Annual report	UC Davis	Visibility cameras removed in 1995
ORCA	Physical parameters in the main cave	1980	Temperature, relative humidity, water flow, air flow		Unpublished report	Park files	
ORCA	Radon and carbon dioxide in		Safety -- sources of				

Park(s)	Object monitored, or monitoring project	Year(s)	Parameters of primary interest	Covariate(s)	Product(s)	Metadata location and elements	Comments
	cave		radon and CO_2 in cave				
ORCA	Temperatures and relative humidity in main cave	1988-1989	Effects of airlocks to mitigate tunnel airflow changes		Graphs, unpublished reports	Park files and library	
	2. Ecotones / distributions						
ORCA	Vegetation mapping	1989	Size and location of plant communities	Fire history, based on fire scars	Unpublished report	Park files and library	
	3. Weather monitoring						
LABE	Temperature and relative humidity	Hygrotherm ograph operations: 1978-1979, 1982-1983, 1985-1998. Datalogger operations: 1998-Present.	Daily temperature daily humiity		Daily temp. and rel. humidity data	1978-1998 on paper hygrothermogra ph charts 1998 to present digital datalogger files Data collected at headquarters weather station	Data collected at Headquarters weather station
LABE	Weather monitoring	1946-Present	Daily temperature and precipitation		Contribution to national weather statistics, daily report to NWS (Medford), internal report, internal database		National weather Service Cooperative Observer weather station at park headquarters
LABE	Temperature and relative humidity in caves	Balcony chamber 1999-2002 Beaconlight 1999-2002 Paradise Alleys 1998-2002 Labyrinth	Hourly temperature and humidity		Hourly temperature and relative humidity data	Data before 1997 generally on paper hygrothermogra ph charts, post '97, digital datalogger files	

Park(s)	Object monitored, or monitoring project	Year(s)	Parameters of primary interest	Covariate(s)	Product(s)	Metadata location and elements	Comments
		(Rh only) 1998-2002 Thunderbolt 1998-2002 Crystal 1980-1983, 1988-Present Indian Well 1982-1985 Fern Cave 1984, 2001-2003					
LAVO	Climate at Manzanita Lake	1988-Present	Wind speed and direction, temperature, relative humidity, precipitation, solar radiation		Annual report	Air Quality Division and ARS	
LAVO	Climate at HQ	2000-Present	Precipitation, temperature				
LAVO	Climate at Lake Helen	2003-Present	RH, solar radiation, temp, wind speed/direction		Hourly readouts	CA Dept. of Water Resources	Data collected via satellite
LAVO	Climate Monitoring (RAWS in backcountry)	1995-Present	Relative humidity, temperature, precipitation, wind speed and direction, fuel moisture		Internal reports	Park files	Hat Mountain RAWS operated since 1995, Summit Lake RAWS operated since 2001?
ORCA	Paleotemperatures in caves		Uranium-thorium dating, oxygen isotopes		M.S. thesis	Park library	
ORCA	Daily recording of temp., rel. humidity, and precipitation	1980s-Present	Changes in precip. and temperature	El Niño's, La Niña's, PDOs, etc.			
ORCA	Growth rates of speleotherms	2001	Climate change		Ph.D.	Park library	

Park(s)	Object monitored, or monitoring project	Year(s)	Parameters of primary interest	Covariate(s)	Product(s)	Metadata location and elements	Comments
	during last 0.5 million yrs				dissertation		
WHIS	Fire Weather	1974-Present	Temperature, rainfall, wind speed, cloud cover, and fuel moisture.			WHIS Fire Office and online WIMS Program	
WHIS	NOAA climate-monitoring station	2002-Present	Temperature, precipitation, wind speed, solar radiation, and infrared surface temperature			NOAA and UNR	
	D. Anthropogenic influences						
	1. Trail / road counters						
LABE	Visitor use -- road counters						
LABE	Visitor use -- trail registers	1989-Present	Monthly use, selected trails	Backcountry day/overnight use (inferred from registers)	Internal reports; monthly visitor-use report	\\Labe01\teams\Resource Management\Visitor use documents	
LAVO	Trail counters	Lassen Peak: 1994, '96, '97, others?; Summit Lake: 1992	Visitor counts		Internal reports	Park files	
ORCA	Monthly records of #cars per cave visitation	1980 to Present	Impacts to caves				
	2. Other monitoring of visitor impacts?						
LABE	Visitor use -- lantern checkout	1989-Present	Number of people visiting cave(s)		Internal report	\\Labe01\teams\Resource Management\Visitor use documents	
LABE	Visitor use -- cave counters	1985-	Weekly use,		Internal reports;	\\Labe01\teams\	

Park(s)	Object monitored, or monitoring project	Year(s)	Parameters of primary interest	Covariate(s)	Product(s)	Metadata location and elements	Comments
		Present	selected caves		monthly visitor-use report	Resource Management\Visitor use documents	
LAVO	Tabulation of backcountry use	1992(?)-Present	Visitor use (person-days), by area by season		Internal reports	Park files	
ORCA	Vandalism of cave features	1991, 1995	Degree of vandalism; location				
ORCA	Compaction of dirt trail in cave	2004	Degrees of compaction over time (need measuring technique)				
	E. Evolutionary processes? (e.g., genetic sampling)						
	1. Monitoring of rare habitat types (e.g., wetlands, rare soil types, ephemeral springs, cliffs, ice caves, etc.)						
LAVO	Drakesbad meadow well	2001-Present	Water-table elevations		Master's thesis, in progress	CSU files	Master's thesis by Lindsay Patterson, Colorado State University
ORCA	Wetland mapping	2003 (incomplete)	Geographic locations				
WHIS	*Puccinellia howellii* and their obligate habitat (=mineral springs)	1991, 1993, soon to include 2004	Cover of *Puccinellia* and associated spring species	Substrate, hydrology, water and soil chemistry.	Caltrans mitigation report; HSU publication in Madrono	J. Gibson's desk.	Hoepfully, we will be archiving the raw data soon.

ATTACHMENT 2: POTENTIAL CRITERIA FOR EVALUATING EXISTING MONITORING PROGRAMS WITHIN THE KLAMATH REGION

1. Extent of the sampling, both temporally and spatially
    a. Sampling frequency is a secondary consideration for the former, whereas sampling intensity within the stated domain of interest is a secondary consideration for the latter (statistical power is one metric, particularly the amount of replication relative to the natural variability of the ecosystem component)
    b. For this appendix, I would propose that any program that has not made measurements **across at least four years** should not be included as an example of a "monitoring program."
2. Degree to which agency or other entity has made a financial commitment to continuing measurement of the taxon or ecosystem property of interest
    a. This may be ensured by a species' status – invasive, T&E, etc.
3. Repeatability of the program's methods (i.e., does it use widely accepted protocols, or (less preferably) well-documented, consistent methods?)
4. Comprehensiveness of the sampling, with respect to potential occurrences of the species in the Klamath ecoregion OR potential elements of the clade, functional group, guild, community or habitat type
    a. Example: For the former, does the program consistently sample a strong fraction of the known populations of a montane-forest habitat-obligate bird, or only a small number of sites, even if in great detail? For the latter, and using the same species, does the program monitor ONLY that species, or also other bird species found in montane forests?
5. Results, analyses, interpretations, or some combination thereof have been subjected to peer review in the scientific literature.
6. Viewed through the lens of adaptive management, is there evidence that management direction has been changed as a result of the monitoring results?
    a. I.e., are policy or legislative vehicles in place that ensure translation of the monitoring program into management action or policy?
7. Are they well connected either to an ecological process of interest to the network (e.g., climate change, nutrient cycling/eutrophication, etc.) OR a particular management action or disturbance?
    a. An alternative criterion here is how strong are auxiliary data that relate trend in the resource(s) to putative causes of that trend?